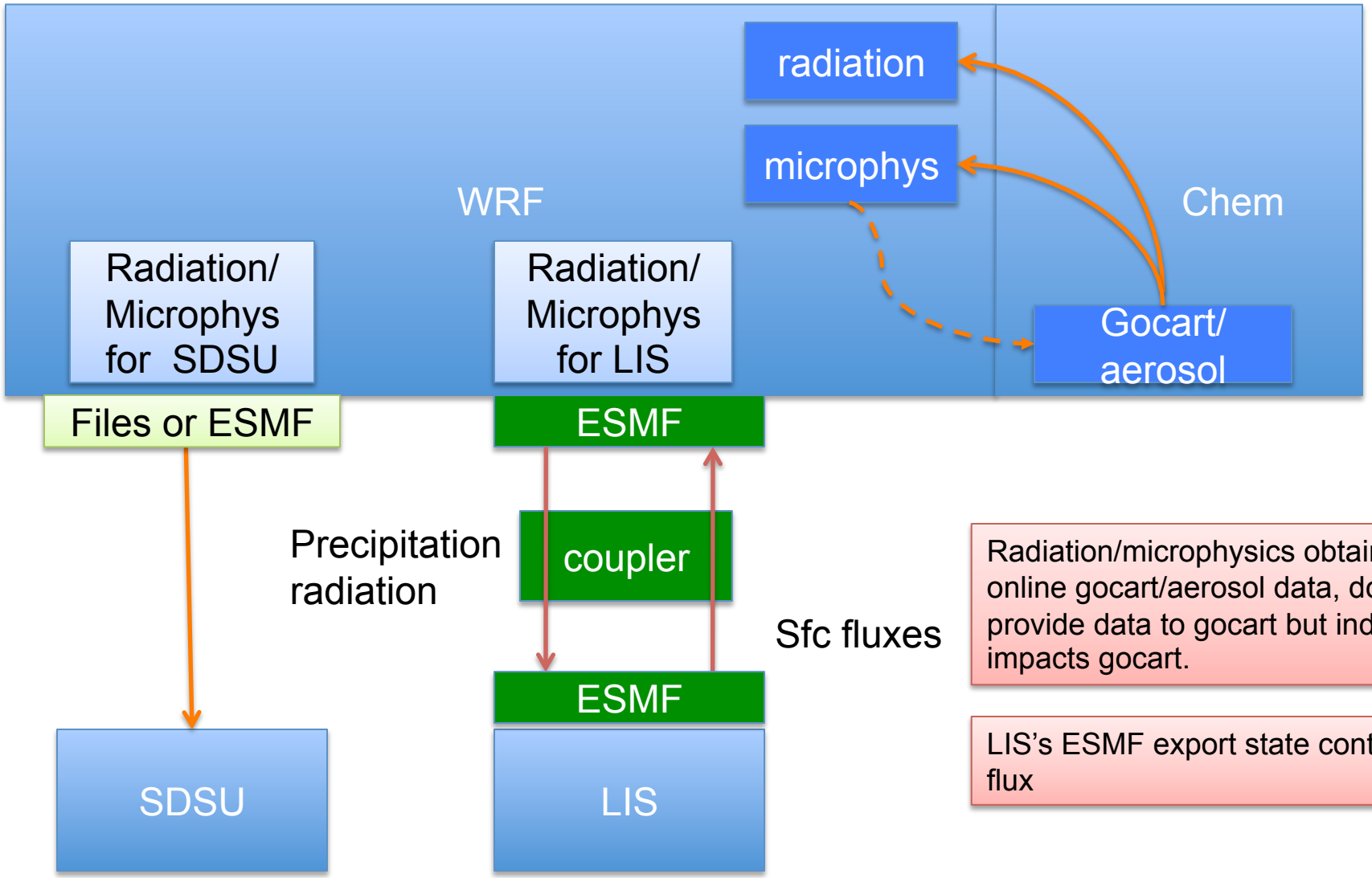
NU-WRF Project:
Updated Requirement Analysis and Design

Shujia Zhou
NASA GSFC SIVO

Feb. 4, 2010

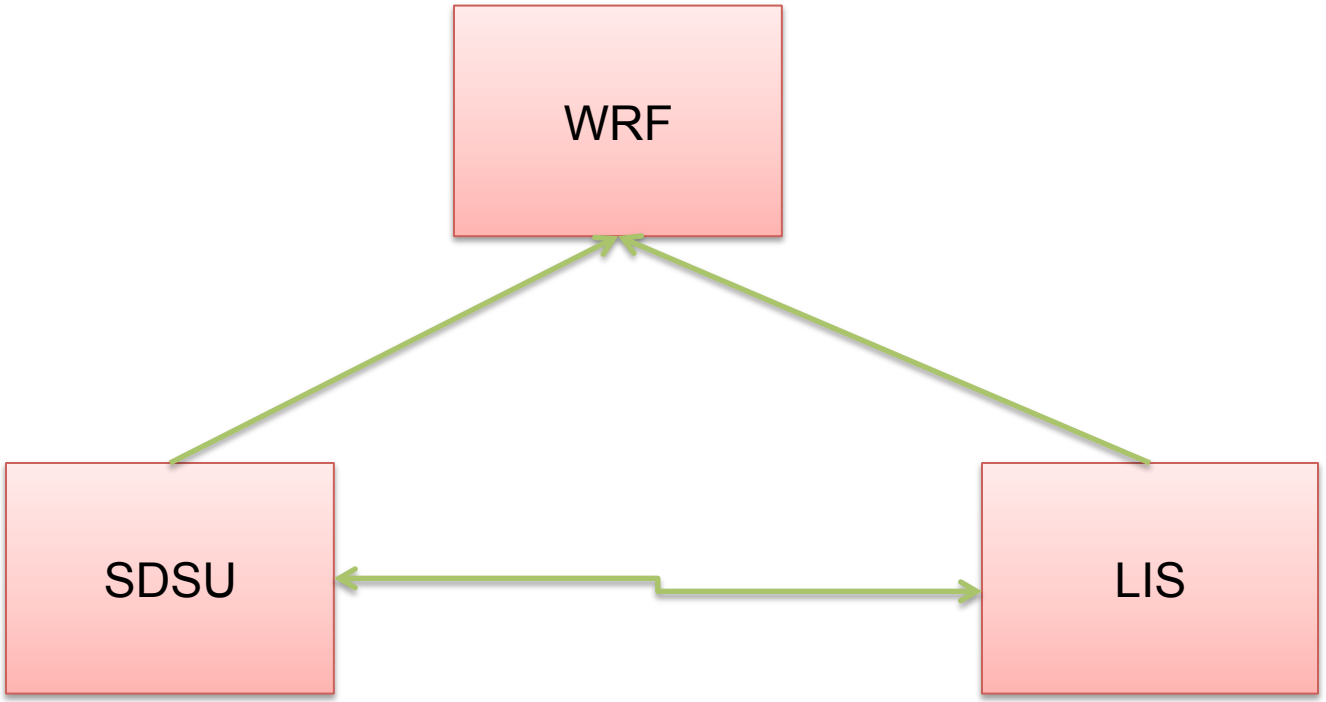
Target System Architecture



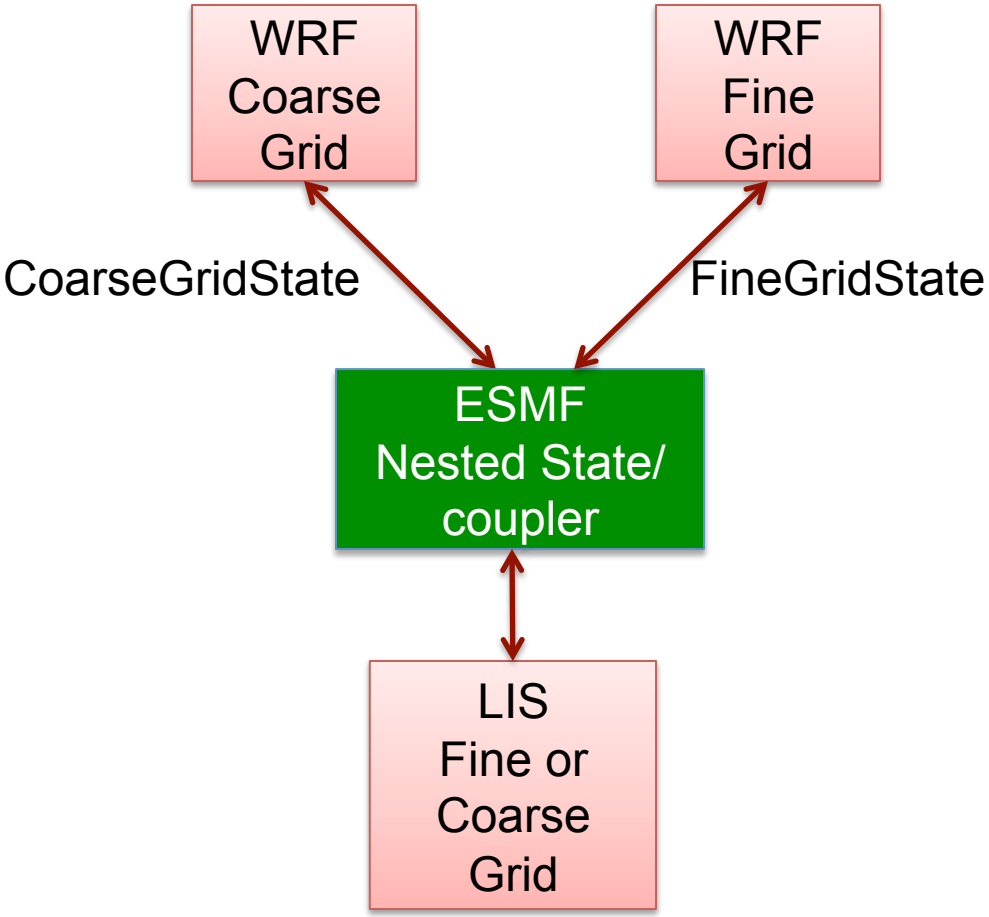
Radiation/microphysics obtains online gocart/aerosol data, does not provide data to gocart but indirectly impacts gocart.

LIS's ESMF export state contains flux

Target System Architecture: ESMF Component Based



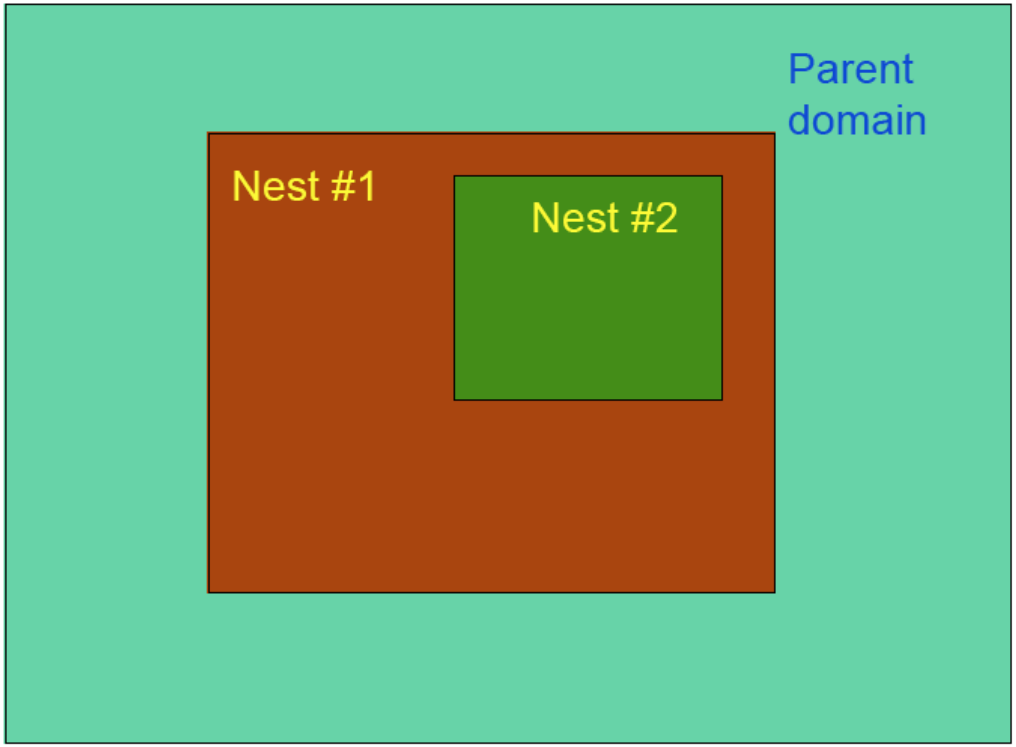
Target System Architecture: LIS-WRF Nested Grid Coupling: Design



1. Coupling is running in serial
2. Use ESMF alarm to determine when add/extract data to/from the coarse- or fine-grid ESMF state.
3. Run high-resolution LIS so that only one LIS component is needed (LIS uses columns)
4. This architecture is valid beyond two-level nested grid
5. In the process of analyzing and testing

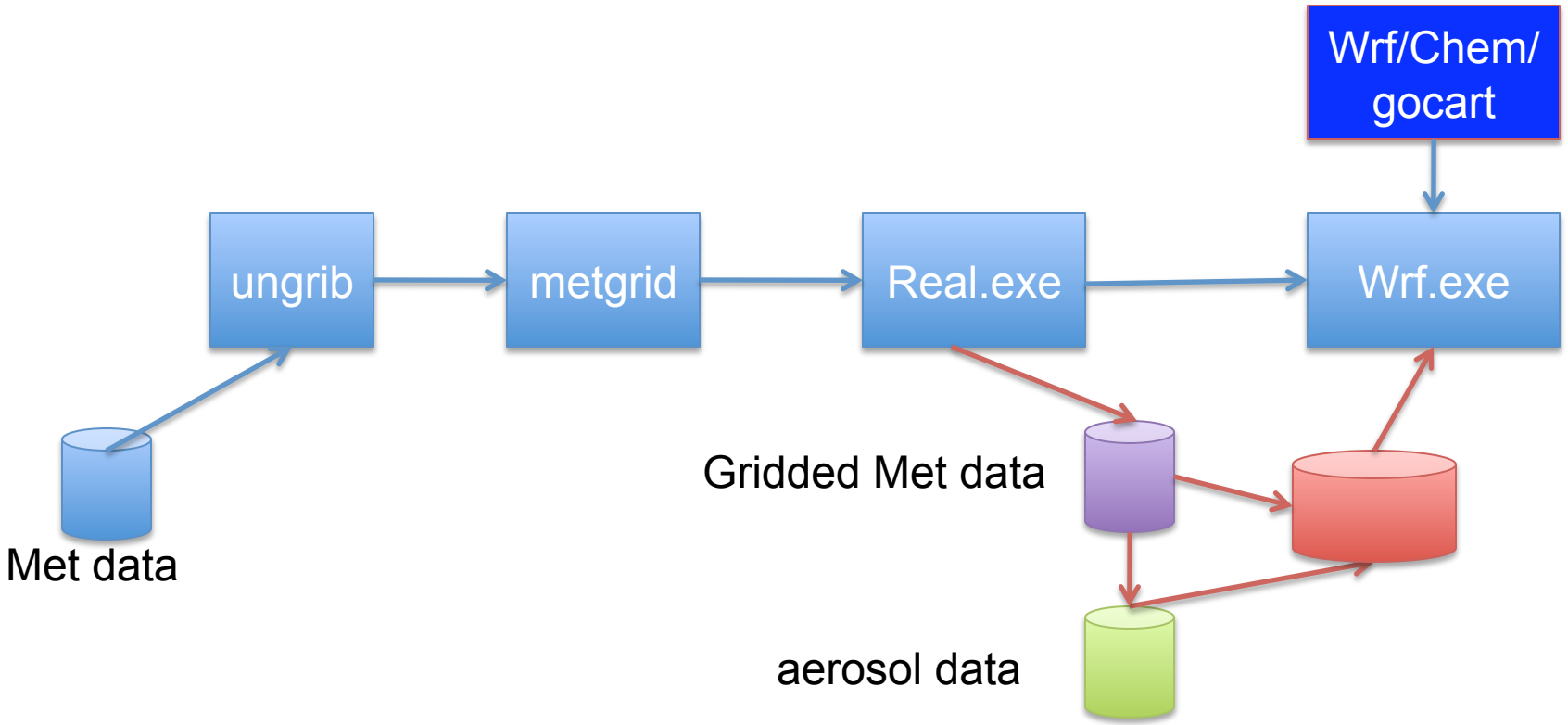
WRF Nested Grid

Two levels of nests, with nest #1 acting as the parent for nest #2



1. LIS-WRF needs static and two-way nesting
2. WRF Whem/GOCART needs nested grid to initialize and update lateral boundaries with GCM data
3. Parent grid provides the boundary condition for child grid.
4. Child grid is not near parent grid to reduce the problem.

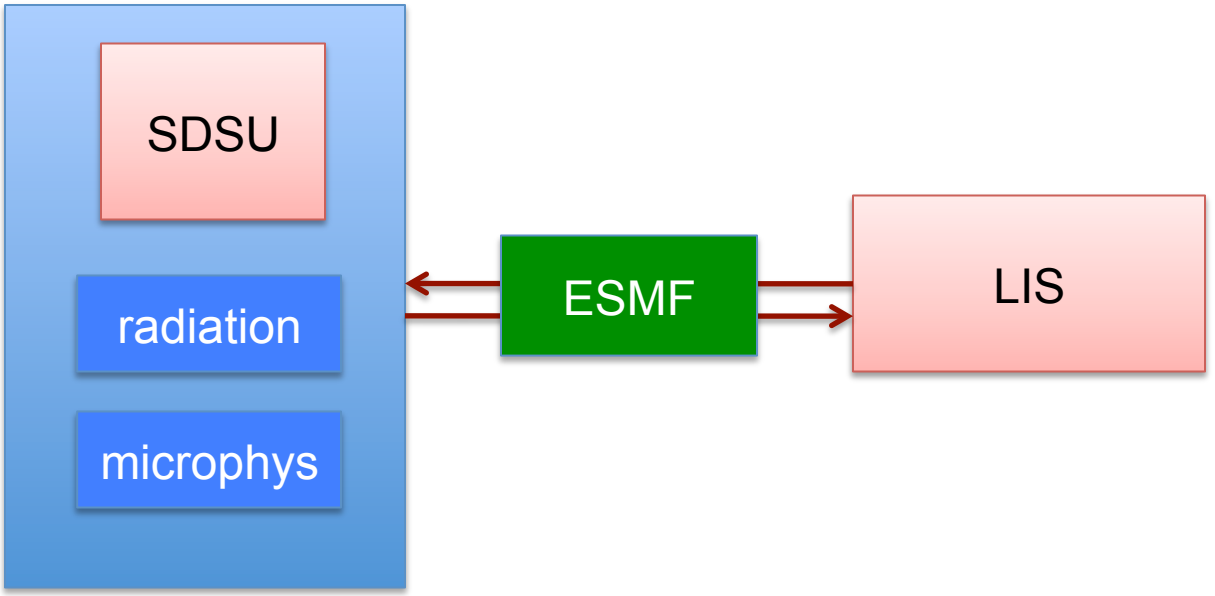
Initialize and Update the Lateral Boundaries of GOCART with GCM



Target System Architecture: GOCART-LIS Direct Coupling (Offline)

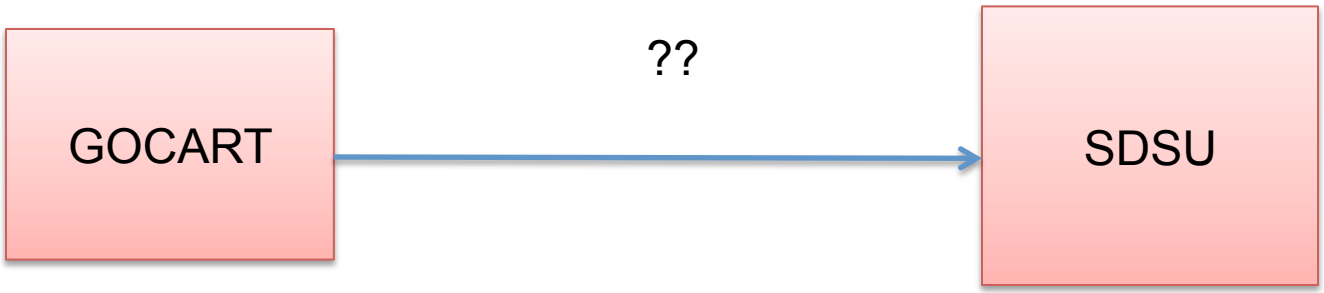
- For offline coupling, use standalone GOCART and couple via netcdf. This can be done in Feb.
- For online coupling, use wrf chem/gocart rather than standalone gocart

Target System Architecture: LIS-SDSU Direct Coupling



Step 1: LIS->SDSU coupling via a file with Netcdf and implementing in the mid of Feb
Step 2: SDSU is compontized with ESMF
Step 3: Use ESMF to handle two-way regridding issue in online coupling

Target System Architecture: GOCART-SDSU Direct Coupling



There is not enough work force/time to do GOCART-SDSU coupling at this time.

Support Test Cases

- Aerosol-Monsoon Cycle over India
  - Aerosol – radiation coupling
    - Online with WRF CHEM or offline with data files?
- 2009 CA wild fires
  - Aerosol –radiation/cloud(?) physics coupling
    - Online with WRF CHEM or offline with data files?
- Dust emission
  - Aerosol-land surface coupling
    - Offline via netcdf

Support Test Cases (Continued)

- MSFC Testing: Real-time NSSL WRF system
  - 10 April 2009 (tornado/large hail outbreak, SE U.S.)
    - GOCART/aerosol due to wildfires
      - Online gocart-radiation coupling in wrf?
  - T.S. Erin in Aug 2007
    - Soil moisture was excessively wet over OK due to antecedent precipitation from the Spring/Summer 2007
      - LIS-WRF coupling
  - 28 March 2007 (tornado outbreak, poor performance in Control runs due to excessive boundary layer cloud cover)
    - Physics testing
      - New radiation/microphysics in wrf

Support Test Cases (Continued)

- Cloud-radiation-aerosol
  - Use online coupling via WRF CHEM aerosol
    - C3VP case (00Z 1/20 - 00Z 1/23, 2007)
    - California snow case (12Z 2/27 - 00Z 2/29, 2006)
    - Hurricane cases (Hurricane Wilma 2006, Typhoon Morakot 2009)
    - Indian Monsoon (May/June, 2005/2006) (aerosol)

Support Test Cases (Continued)

- LIS-SDSU
  - First use netcdf (offline) and then ESMF (online)
    - Canadian CloudSAT/CALIPSO Validation Project (C3VP)
    - U.S. Southern Great Plains (SGP)